LF NETWORKING

LFN Developer & Testing Forum

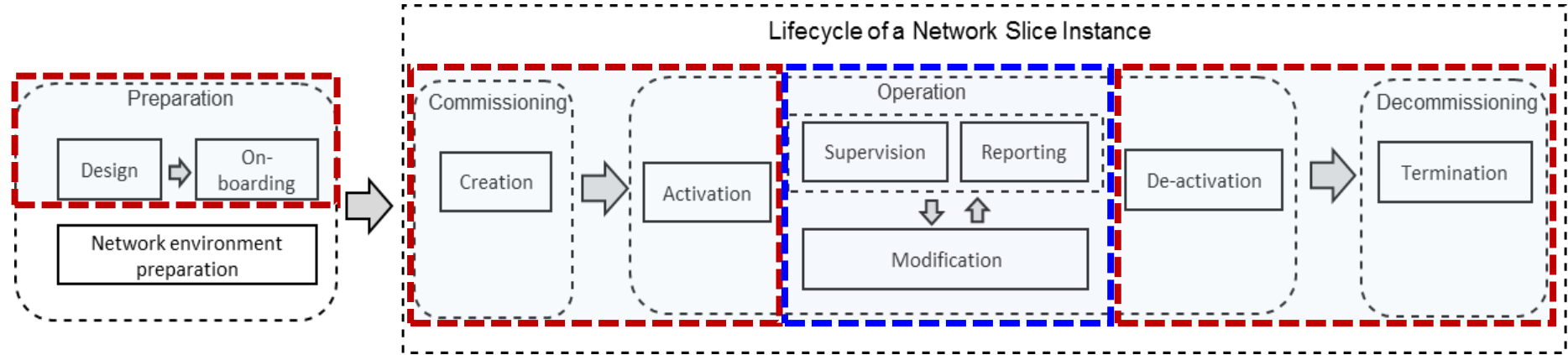# E2E Network Slicing use case : Overview & Istanbul Release Demo

Participants: CMCC, Wipro, Huawei, AT&T, IBM, LTTS, DT, TIM, QCT, Amdocs, Tech Mahindra, Reliance Jio, Tencent, China Telecom, highstreet technologies

Presenters: Lin Meng (CMCC), Ahila P (Wipro),
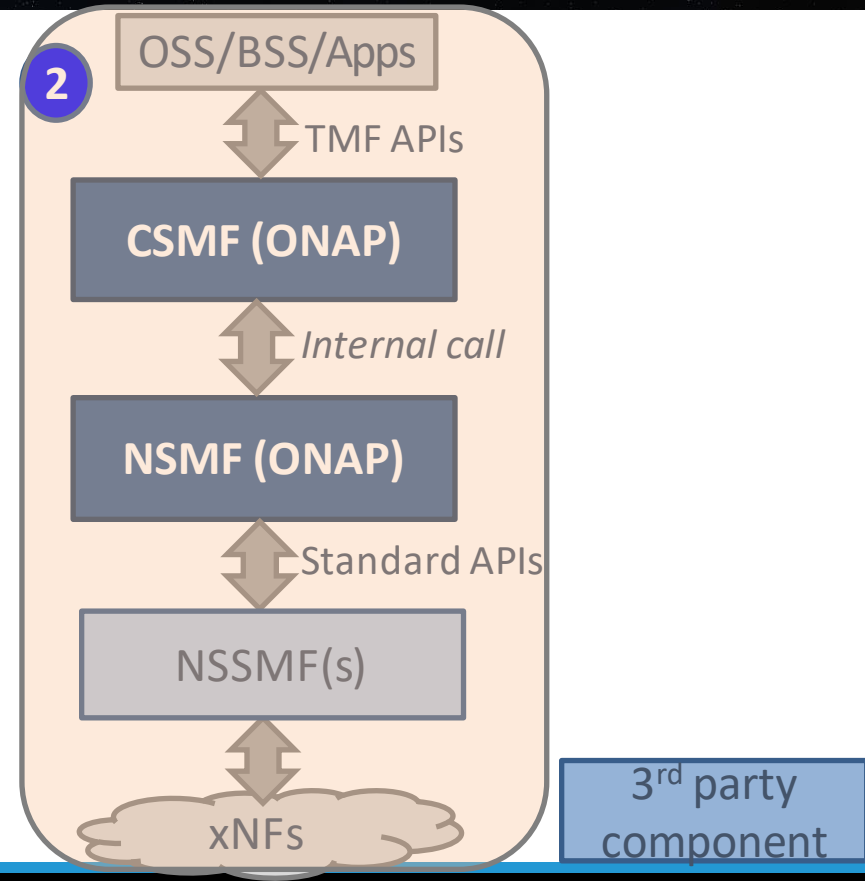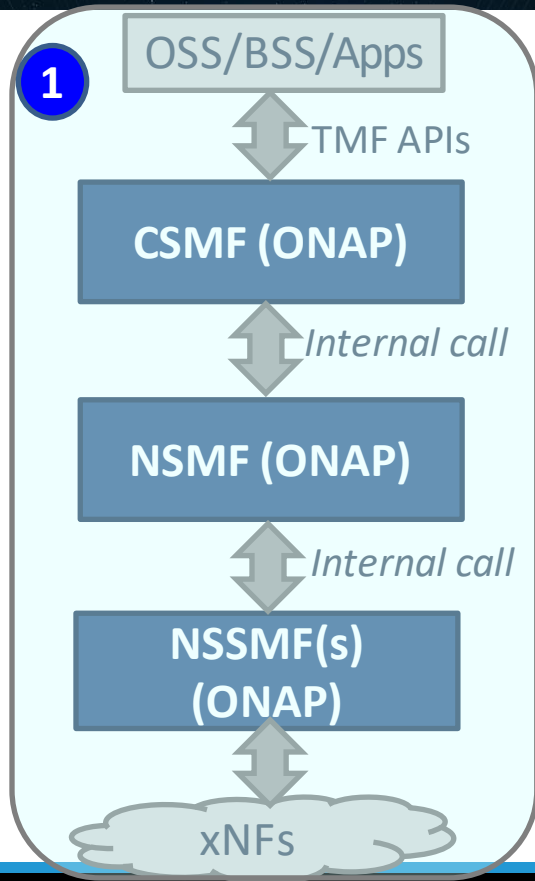
Objectives

1. **Implement ONAP- based Slice Management functions defined by 3GPP (CSMF + NSMF + NSSMF)**
2. **Demonstrate e2e slice design, instantiation and operation, including RAN, Core and Transport slice sub-nets**
3. **Provide flexible architecture choices to operators for deployment scenarios (ONAP based xMF or 3rd party xMF)**

Lifecycle of a Network Slice Instance

Ref.: 3GPP TS 28.530

Frankfurt/Guilin scope   Focus area for Honolulu, Istanbul and beyond
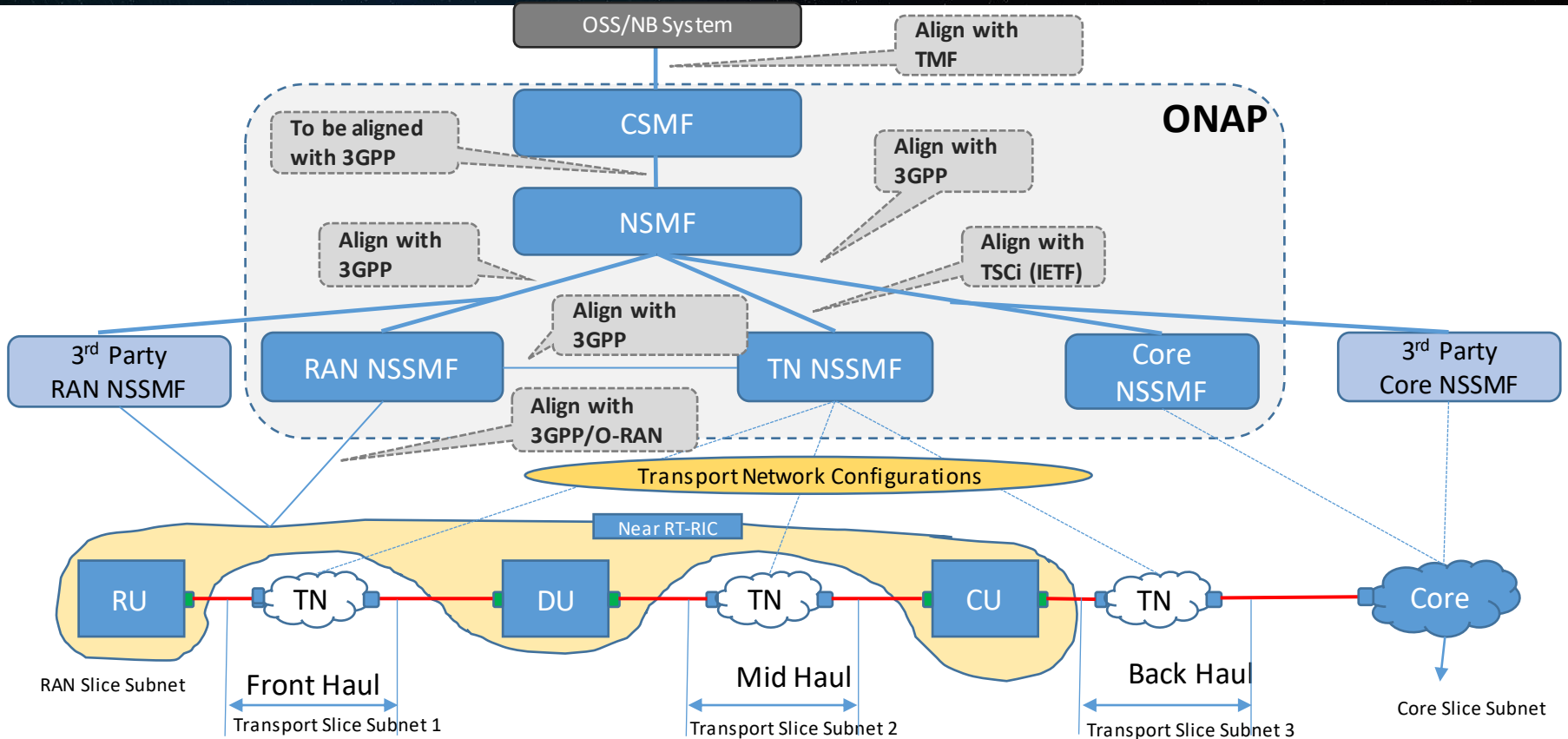
- **Design and pre-provision**: Creation of necessary slice/slice sub-net templates.
- **Instantiation/Configuration, Activation/Deactivation and deallocation/termination** of NSIs, including its constituent NSSIs (RAN, Core and Transport).

E2E Network Slicing - Supported Architectures

1

OSS/BSS/Apps

↕ TMF APIs

CSMF (ONAP)

↕ *Internal call*

NSMF (ONAP)

↕ *Internal call*

NSSMF(s) (ONAP)

↕

xNFs

2

OSS/BSS/Apps

↕ TMF APIs

CSMF (ONAP)

↕ *Internal call*

NSMF (ONAP)

↕ Standard APIs
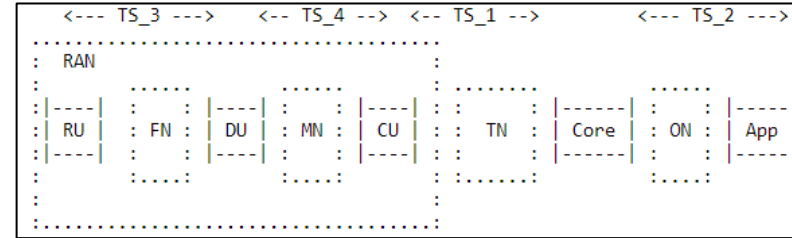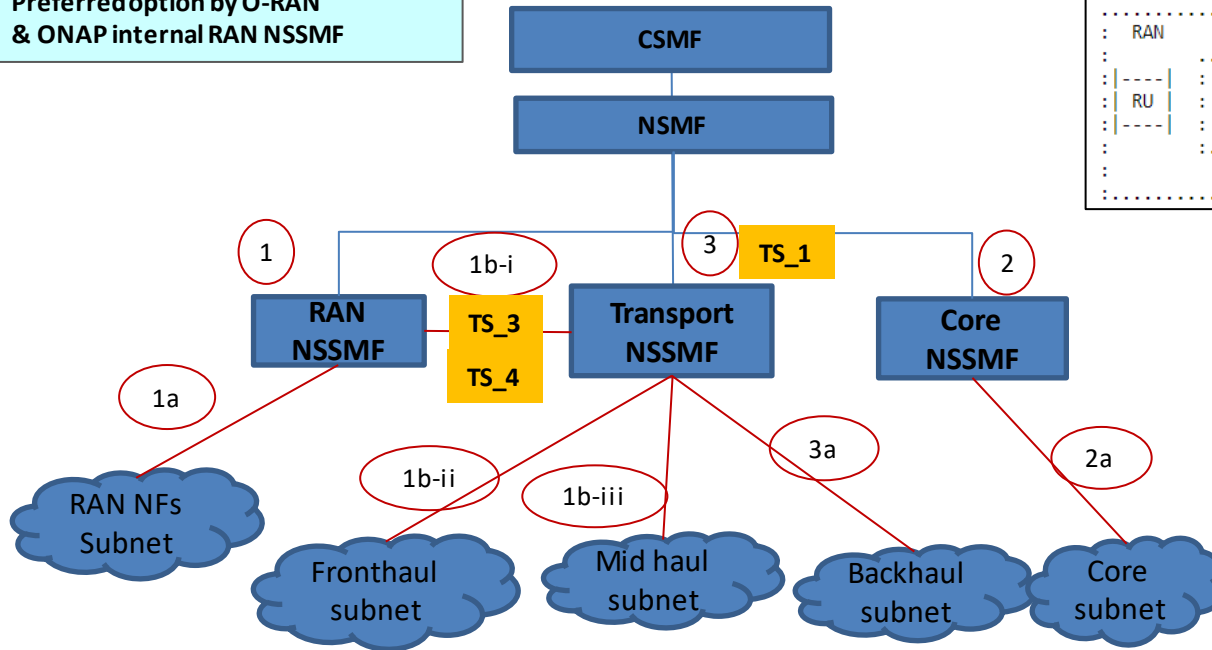
NSSMF(s)

↕

xNFs

3rd party component

E2E Network Slicing: Architecture & Interfaces

RAN & Transport Subnet: Interaction Scenario 1

Preferred option by O-RAN & ONAP internal RAN NSSMF

```
<--- TS_3 --->   <-- TS_4 -->  <-- TS_1 -->        <--- TS_2 --->
: RAN
:|----|  :     :|----|  :     :|----|  :     :       :|------| :     :|-----|
:| RU |  : FN  :| DU |  : MN  :| CU |  :     :  TN   :| Core | : ON  :| App |
:|----|  :     :|----|  :     :|----|  :     :       :|------| :     :|-----|
```

Diagram: CSMF → NSMF → (1) RAN NSSMF, (3) TS_1, Transport NSSMF, (2) Core NSSMF

- RAN NSSMF (1b-i) TS_3 TS_4 → Transport NSSMF
- (1a) RAN NFs Subnet
- (1b-ii) Fronthaul subnet
- (1b-iii) Mid haul subnet
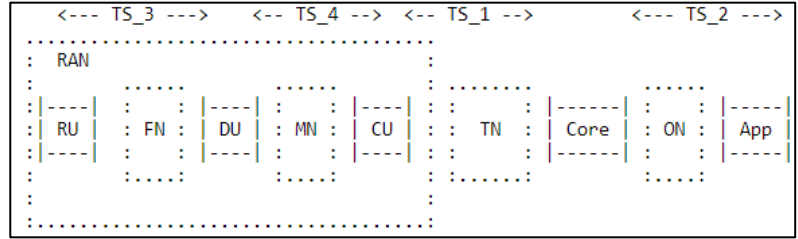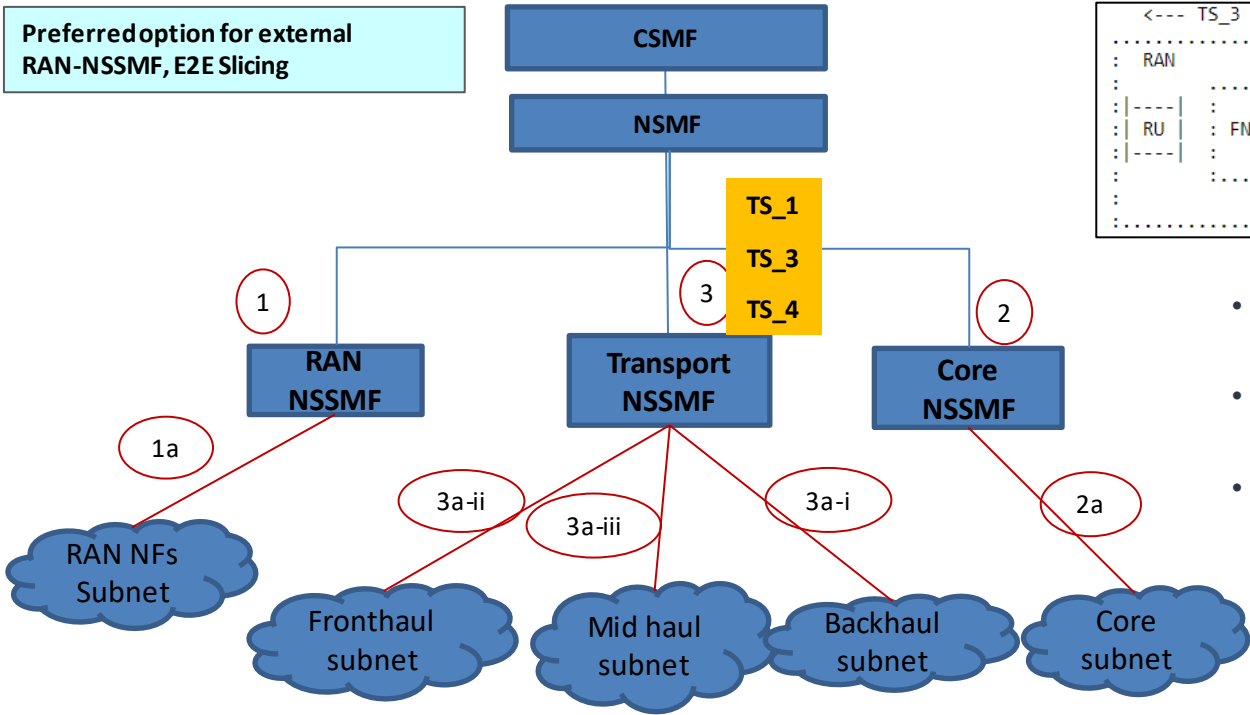- (3a) Backhaul subnet
- (2a) Core subnet

- TS_1 is backhaul transport slice; TS_3, fronthaul; TS_4, midhaul.

- TN MD (T-NSSMF) receives TS_1 from NSMF (step 3), and TS_3 and TS_4 from RAN NSSMF (step 1b-i).

- TN MD then configures backhaul (3a), fronthaul (1b-ii), and midhaul (1b-iii), respectively.

- RAN NSSMF shall be responsible for determination of Slice Profile of FH, MH and RAN NFs.
- RAN NSSMF shall be responsible for entire RAN subnet comprising FH and MH (stitching together, CL actions, etc.)

RAN & Transport Subnet: Interaction Scenario 2

Preferred option for external RAN-NSSMF, E2E Slicing

- TS_1 is backhaul transport slice; TS_3, fronthaul; TS_4, midhaul.
- TN MD (T-NSSMF) receives TS_1, TS_3 and TS_4 from NSMF (step 3).
- TN MD then configures backhaul (3a-i), fronthaul (3a-ii), and midhaul (3a-iii), respectively.

NSMF shall be responsible for determination of Slice Profile of FH, MH and RAN NFs.
NSMF shall be responsible for stitching together e2e slice including FH and MH.

Istanbul Release Highlights

- E2E Network slicing with internal NSSMFs (**Option 1)**
  - Istanbul Release Update: Integration with NSMF and NSSMFs for shared and non-shared slices is completed; Integration with the ACTN Simulator is done
  - Achieved in Honolulu Release: E2E Slicing with external Core NSSMF Simulator was done, ACTN Simulator was bypassed.

- E2E Network slicing with external Core & RAN NSSMFs **(Option 2)**
  - Istanbul Release Update: Slice reuse is implemented and tested; OOF solution is incorporated and considered for E2E Slice termination
  - Achieved in Honolulu Release : E2E Slice creation was done; termination was completed without OOF involvement

- NSMF driven Transport (FH, MH) Slices (New)
  - NSMF is responsible for E2E slice including the TN - FH & MH slices

Istanbul Release Highlights

- CPS Integration (New)
  - CPS is used in place of Config DB for RAN slice reuse, activate/deactivate and terminate scenarios
- Closed Loop
  - Istanbul Release Update: E2E Closed loop testing is completed. CPS is integrated in the closed loop flow except for applying the new configurations to RAN slice.
  - Achieved in Honolulu Release: Closed loop with Config DB was completed; PM data generation was skipped, directly data was fed to PM Mapper
- KPI Monitoring
  - Istanbul Release Update: Policy driven KPI computation is implemented
  - Achieved in previous releases: KPI computation formula was read from app-config

H-release:
https://wiki.onap.org/download/attachments/93011484/E2E_Network_Slicing_LFN_Jun_2021_Demo.mp4?version=1&modificationDate=1623170076000&api=v2

Demo Items

S.No	Scenarios	Lab Environment
1	E2E Slice creation with internal CORE, RAN and TN NSSMFs	Win Lab, Rutgers University
2	E2E Slice Reuse with CPS integration (with internal CORE, RAN and TN NSSMFs)	Win Lab, Rutgers University
3	Option2 (External NSSMFs) - E2E slice reuse, termination	Win Lab, Rutgers University
4	NSMF driven TN Slices - E2E slice creation	Internal Lab, Wipro

Operation Guidance: https://wiki.onap.org/display/DW/User+Operation+Guidance+-+Istanbul+Release

Internal Demo Artifacts: https://wiki.onap.org/display/DW/Istanbul+Release+Tracks+-+Demo+Artifacts

E2E Network Slicing - Demo

Pending Commits or JIRAs

- https://jira.onap.org/browse/SDNC-1654

- https://gerrit.onap.org/r/c/so/+/125737

- https://jira.onap.org/browse/SO-3835

E2E Network Slicing Alignment with SDOs

Standards Body	Alignment Reference(s)
3GPP (Rel. 16)	○ TS 28.530 (Concepts, requirements) ○ TS 28.531 (Slice and Slice sub-net LCM) ○ TS 28.541 (Network Resource Models) ○ TS 23.501 (Procedures in Control Plane) ○ TS 28.552 and TS 28.554 (PM and KPIs)
TMF	○ TMF 641 (Service Order – CSMF NB) ○ TMF 628 (PM and KPI monitoring – just started)
ETSI	○ ZSM 002 ZSM Framework ○ ZSM 003 E2E Network Slicing Architecture ○ ZSM 009 Closed-loop Automation
IETF	○ draft-rokui-5g-ietf-network-slice-00 ○ draft-ietf-teas-actn-vn-yang ○ RFC 8795: YANG models for TE topologies
O-RAN	○ O1 (RAN Configuration, notifications, PM data) – in progress ○ O2 (not started yet) ○ A1 – just started ○ RAN architecture and functional split (Non-RT RIC, Near-RT RIC, SMO) – in progress

Thank You